



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address COMMISSIONER OF PATENTS AND TRADEMARKS
PO Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/751,614	12/29/2000	Phil Geng	884.387US1	8591

7590 05 06 2003

SCHWEGMAN, LUNDBERG
WOESSNER & KLUTH, P.A.
P.O. Box 2938
Minneapolis, MN 55402

[REDACTED] EXAMINER

ALCALA, JOSE H

[REDACTED] ART UNIT

[REDACTED] PAPER NUMBER

2827

DATE MAILED: 05/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/751,614	GENG ET AL.
Examiner	Art Unit	
	Jose H Alcala	2827

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 10 February 2003.

2a) This action is **FINAL**. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

sposition of Claims

4) Claim(s) 18-25, 27, 28 and 30-47 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 18-25, 27, 28 and 30-47 is/are rejected.

7) Claim(s) _____ is/are objected to.

8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) The proposed drawing correction filed on 10 February 2003 is: a) approved b) disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) All b) Some * c) None of:
1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. ____.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) The translation of the foreign language provisional application has been received.

15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) Notice of References Cited (PTO-892)
2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____

4) Interview Summary (PTO-413) Paper No(s). _____
5) Notice of Informal Patent Application (PTO-152)
6) Other: _____

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 2/10/03 have been fully considered but they are not persuasive.
2. As per applicant argument that the "pad-through hole combination", has a "dumb-bell shape" and not "substantially circular", examiner points out that the term "substantially circular" is broad enough to allow interpretation of the land as taught by Sherman, to read on the claimed structure, therefore the rejection stands.
3. As per applicant arguments that Perfecto, fails to disclose solder balls adhering to circular pads, examiner responds that the Perfecto reference is used to teach an offset circular land (reference number 30) that connects a via to another circuit layer, in order to modify the Sherman invention, and not for the reasons stated by the applicant.
4. In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 37,38,43 and 45-47 are rejected under 35 U.S.C. 102(b) as being anticipated by Sherman (US Patent No. 5,784,262).

Regarding Claim 37, as best understood by the examiner: Sherman teaches an electronic assembly comprising: an integrated circuit package (reference number 10) having a plurality of contacts (reference number 14) and a centerline (the imaginary line in figure 3, between reference numbers 46 and 44) separating the plurality of contacts into two substantially equal portions (reference numbers 46 and 44); and a substrate (reference number 20) having a plurality of lands (reference number 21) respectively aligned with the plurality of contacts, wherein at least the contacts or the lands are coated with a solder, each land having a via (reference number 22) offset therein extending into the substrate, each via having a geometric center located in a region between the geometric center and the perimeter of its associated land, wherein the lands comprise a first group (reference number 46) having vias offset in a first direction and a second group (reference number 44) having vias offset in a second direction, and wherein the first and second groups are on opposite sides of the centerline (See figure 3)

Regarding Claim 38, the limitation that: "wherein, during a solder reflow operation, surface tension forces in molten solder residing between the respectively aligned contacts and lands are substantially equalized between the first and second groups of lands", is a product by process limitation. If the product in the product-by-process claims are the same as or obvious from a product of the prior art, the claims are unpatentable even though the prior product was made by a different process. See *In re Thorpe*, 227 USPQ 964,966 (Fed.Cir 1985). A "product by process" claim is directed to the product *per se*, no matter how actually made, *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wertheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product *per se* which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that applicant has the burden of proof in such cases, as the above case law makes clear.

Regarding Claim 43, Sherman teaches a substrate (reference number 20) comprising a plurality of lands (Reference number 21) and a centerline (the imaginary line in figure 3, between reference numbers 46 and 44) separating the plurality of lands into two substantially equal portions (reference numbers 46 and 44), each land having a substantially circular perimeter and a geometric center (See figure 2A), wherein each land has a via offset therein, wherein each via has a geometric center located in a

region between the geometric center and the perimeter of its associated land, wherein the lands comprise a first group (reference number 46) having vias offset in a first direction and a second group (reference number 44) having vias offset in a second direction, and wherein the first and second groups are on opposite sides of the centerline (see Figure 3).

Regarding Claim 45, Sherman teaches the vias (reference number 22) are circular.

Regarding Claim 46 and 47, Sherman teaches that geometric centers of vias of the first group of lands are offset in the first direction and the geometric centers of vias of the second group of lands are offset in the second direction (See figure 3)

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 18-20,34-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sherman (US Patent No. 5,784,262) in view of Perfecto et al. (US Patent No. 5,464,682).

Regarding Claim 18, Sherman teaches a substrate (reference number 20) comprising: a plurality of lands (reference number 21), each land having a substantially

circular perimeter and a geometric center (See figure 2A), wherein each land has a via (reference number 22) therein that is offset with respect to the geometric center of the land (See figure 1), and a plurality of solder balls (reference number 16), each solder ball adhering to a respective one of the lands (See figure 1) but fails to explicitly teach that each solder ball is adhering to the entire respective land.

Perfecto teaches in figure 2, an offset circular land (reference number 30) that connects a via to another circuit layer.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Sherman and Perfecto in order to have the Sherman land with the same shape as the Perfecto land, in such a way that each solder ball can adhere to the entire land. Thus making the land as a single piece or element, reducing the manufacturing steps for the lands, saving time and manufacturing costs.

Regarding Claim 19, Sherman teaches that each via has a geometric center, and wherein the geometric center of each via is in a region between the geometric center and the perimeter of its associated land (see figure 2A)

Regarding Claim 20, Sherman teaches that the geometric centers of vias of adjacent lands are offset in substantially the same direction (See Figure 3).

Regarding Claim 34, Sherman teaches a substrate (reference number 20) comprising: a plurality of lands (reference number 21), each land having a geometric center (See figure 2A), wherein each land has a via (reference number 22) therein that is offset with respect to the geometric center of the land (See figure 1), and a plurality of

solder balls (reference number 16), each solder ball adhering to a respective one of the lands(See figure 1) without any material intervening between the solder ball and the respective land, but fails to explicitly teach that each solder ball is adhering to the entire respective land.

Perfecto teaches in figure 2, an offset circular land (reference number 30) that connects a via to another circuit layer.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Sherman and Perfecto in order to have the Sherman land with the same shape as the Perfecto land, in such a way that each solder ball can adhere to the entire land. Thus making the land as a single piece or element, reducing the manufacturing steps for the lands, saving time and manufacturing costs.

Regarding Claim 35, Sherman teaches that each land has an edge (the border of the land), wherein each via has a geometric center, and wherein the geometric center of each via is in a region between the geometric center and the edge of its associated land (see figure 2A).

Regarding Claim 36, Sherman teaches that the geometric centers of vias of adjacent lands (lands of reference number 40) are offset from the geometric centers of such lands in the same direction.

9. Claims 21,25,27-28,30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sherman (US Patent No. 5,784,262) in view of Perfecto et al. (US Patent No. 5,464,682).

Regarding Claim 21, Sherman teaches an electronic assembly comprising: an integrated circuit package (reference number 10) having a plurality of contacts (reference number 14); a substrate (reference number 20) having a plurality of lands (reference number 21), each land having a geometric center and an edge, each land having a via (reference number 22) therein extending into the substrate, each via having a geometric center in a region between the geometric center and the edge of its associated land, and a plurality of solder balls (reference number 16) , each coupling one of the plurality of contacts to a respective one of the plurality of lands, but fails to explicitly teach that each of the solder balls is contacting substantially the entire respective land to the edge of such land.

Perfecto teaches in figure 2, an offset circular land (reference number 30) that connects a via to another circuit layer.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Sherman and Perfecto in order to have the Sherman land with the same shape as the Perfecto land, in such a way that the solder balls are contacting substantially the entire respective land and the to the edge of such land. Thus making the pad as a single piece or element, reducing the manufacturing steps for the lands, saving time and manufacturing costs.

Regarding Claim 25, as best understood by the examiner: Sherman teaches that the lands comprise a first group (reference number 40) having vias offset in a first direction, and a second group (reference number 42) having vias offset in a second direction.

Regarding Claim 27, as best understood by the examiner: Sherman teaches that the geometric centers of vias of adjacent lands (lands of reference number 40) are offset from the geometric centers of such lands in the same direction.

Regarding Claim 28, Sherman teaches an electronic system comprising an electronic assembly having: an integrated circuit package (reference number 10) having a plurality of pads (reference number 14), a substrate (reference number 20) having a plurality of lands (reference number 21), each land having a geometric center and an edge, each land having a via (reference number 22) therein, each via having a geometric center in a region between the geometric center and the edge of its associated land; and a plurality of solder balls (reference number 16), each coupling one of the plurality of pads to a respective one of the plurality of lands, but fails to explicitly teach that each of the solder balls is contacting substantially the entire respective land to the edge of such land.

Perfecto teaches in figure 2, an offset circular land (reference number 30) that connects a via to another circuit layer.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Sherman and Perfecto in order to have the Sherman land with the same shape as the Perfecto land, in such a way that the

solder balls are contacting substantially the entire respective land and the to the edge of such land. Thus making the pad as a single piece or element, reducing the manufacturing steps for the lands, saving time and manufacturing costs.

Regarding Claim 30, Sherman teaches that the geometric centers of vias of adjacent lands (lands of reference number 40) are offset from the geometric centers of such lands in the same direction.

10. Claims 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sherman (US Patent No. 5,784,262) in view of Perfecto et al. (US Patent No. 5,464,682) and further in view of Mehr (US Patent No. 5,936,848).

11. Regarding Claim 22, Sherman modified by Perfecto, as stated supra for claim 21, fails to explicitly teach that each via has a thermally expansive substance residing in the vias. The limitation: "inhibits from causing adjacent contacts of the integrated circuit package to be bridged when the lands and contacts are subjected to heat", is an intended use limitation and it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex Parte Masham, 2 USPQ F.2d 1647 (1987).*

Mehr teaches a thermally expansive substance (reference number 38) residing in the vias. It would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify the combination of Sherman and Perfecto with Mehr, in order to have a thermally expansive substance (reference number 38) residing

in the vias. Thus, having a cover in the via to prevent solder from getting to undesired sections of the device.

Regarding claim 23, Sherman as modified by Perfecto and Mehr, fails to explicitly teach that the thermally expansive substance comprises a volatile organic compound. It would have been obvious to one having ordinary skill in the art at the time the invention was made to make the thermally expansive substance comprising a volatile organic compound, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Regarding claim 24, Sherman as modified by Perfecto and Mehr, teaches that the thermally expansive substance forms a portion of a solder mask (reference number 38 of Mehr), but fails to explicitly teach that the thermally expansive substance comprises a volatile liquid. It would have been obvious to one having ordinary skill in the art at the time the invention was made to make the thermally expansive substance comprising a volatile liquid, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

12. Claims 31-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sherman (US Patent No. 5,784,262) in view of Perfecto et al. (US Patent No. 5,464,682) and further in view of Sakemi et al. (US Patent No. 5,489,750)

Regarding Claim 31, Sherman modified by Perfecto, as stated supra for claim 18, teaches that each land has an edge defining a perimeter, but fails to explicitly teach that each solder ball covers the entire respective land, including the perimeter of such land.

Sakemi teaches that each solder ball (reference number 4) covers the entire respective land (reference number 21) including the perimeter of such land.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify the combination of Sherman and Perfecto with Sakemi, in order to have each solder ball covering the entire respective land, including the perimeter of such land, thus making a more precise bonding and making the quality of the bond easily measurable.

Regarding Claim 32, Sherman modified by Perfecto, as stated supra for claim 18, teaches that each land has an edge defining a perimeter, but fails to explicitly teach that each solder ball adheres to the entire respective land within the perimeter of such land.

Sakemi teaches that each solder ball (reference number 4) adheres to the entire respective land (reference number 21) within the perimeter of such land.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify the combination of Sherman and Perfecto with Sakemi, in order to have each solder ball adhering to the entire respective land and to the perimeter of such land, thus making a more precise bonding and making the quality of the bond easily measurable.

Regarding Claim 33, Sherman modified by Perfecto, as stated supra for claim 18, teaches that each land has an edge and a surface defined by the edge, but fails to

explicitly teach that each solder ball adheres to substantially the entire surface of the respective land.

Sakemi teaches that each solder ball (reference number 4) substantially the entire surface of the respective land.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify the combination of Sherman and Perfecto with Sakemi, in order to have each solder ball adhering to substantially the entire surface of the respective land, thus making a more precise bonding and making the quality of the bond easily measurable.

13. Claims 39-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sherman (US Patent No. 5,784,262) in view of Mehr (US Patent No. 5,936,848). As best understood by the examiner:

Regarding Claim 39, Sherman as stated supra for claim 38, fails to explicitly teach that each via has a thermally expansive substance residing in the vias. The limitation: "inhibits from causing adjacent contacts of the integrated circuit package to be bridged when the lands and contacts are subjected to heat", is an intended use limitation and it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. Ex Parte Masham, 2 USPQ F.2d 1647 (1987).

Mehr teaches a thermally expansive substance (reference number 38) residing in the vias. It would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify the combination of Sherman and Perfecto with Mehr, in order to have a thermally expansive substance (reference number 38) residing in the vias. Thus, having a cover in the via to prevent solder from getting to undesired sections of the device.

Regarding claim 40, Sherman as modified by Mehr, fails to explicitly teach that the thermally expansive substance comprises a volatile organic compound. It would have been obvious to one having ordinary skill in the art at the time the invention was made to make the thermally expansive substance comprising a volatile organic compound, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Regarding claim 41, Sherman as modified by Mehr, teaches that the thermally expansive substance forms a portion of a solder mask (reference number 38 of Mehr), but fails to explicitly teach that the thermally expansive substance comprises a volatile liquid. It would have been obvious to one having ordinary skill in the art at the time the invention was made to make the thermally expansive substance comprising a volatile liquid, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

14. Claims 42 and 44, are rejected under 35 U.S.C. 103(a) as being unpatentable over Sherman (US Patent No. 5,784,262) in view of Perfecto et al. (US Patent No. 5,464,682).

Regarding Claim 42, as best understood by the examiner: Sherman teaches all the limitations as stated supra for claim 37, and that the vias are circular (Figure 2A) but fails to explicitly teach that the lands are circular.

Perfecto teaches in figure 2, an offset circular land (reference number 30) that connects a via to another circuit layer.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Sherman and Perfecto in order to have a circular land. Thus, making the pad as a single piece or element, reducing the manufacturing steps for the lands, saving time and manufacturing costs.

Regarding Claim 44, Sherman teaches all the limitations as stated supra for claim 43, but fails to explicitly teach that the lands are circular.

Perfecto teaches in figure 2, an offset circular land (reference number 30) that connects a via to another circuit layer.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Sherman and Perfecto in order to have a circular land. Thus, making the pad as a single piece or element, reducing the manufacturing steps for the lands, saving time and manufacturing costs.

Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jose H Alcala whose telephone number is (703) 305-9844. The examiner can normally be reached on Monday to Friday.
16. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Talbott can be reached on (703) 305-9883. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-3431 for regular communications and (703) 305-3431 for After Final communications.
17. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

JHA
May 5, 2003

John B. Vigushin
John B. Vigushin
EXAMINER
AM 2827